numerous illustrations. The opening paragraph of § 49 may be taken as a fair example of general "interpretation." For instances of alteration take these two: "unvollkommenen Bundeln" of mosses (p. 197) is rendered "rudimentary vascular bundles (p. 216). Pfeffer would probably deny the morphological implication in the latter phrase; at least he had avoided it in his use of the original adjective. Again: "nachweisbaren Producten" of photosynthesis (p. 299) are not necessarily "visible products" (p. 317), and the change makes the sentence untrue. Nor will it be fair to consider the passage of the English proofs through Pfeffer's hands as equivalent to an endorsement of the translator's particular modes of expression.

The comparison with the original is necessitated further by the avowed changes which Dr. Ewart has wisely introduced. In the main these are indicated by brackets, but this should have been uniformly done. The later literature is cited and other betterments are noticeable. The avoidance of new terms is desirable whenever it does not involve too great circumlocution, and the new book has practically none. We note, however, the increased use of photosynthesis, which is making its way in spite of conservatism, though it is not used consistently. Ewart is in error regarding the term photosyntax (footnote, p. 302), which he rejects as unnecessary. It was defined by the proponent precisely as photosynthesis (p. 292), and could by no means include "all cases of carbon dioxide assimilation."

Some of the slips of the German text have been corrected, but two notable ones in § 40 have been missed. On p. 250 the amount of water transpired under favorable conditions is given as 1 to 10^{cc} per 24 hours "from a single square *centimeter* of leaf surface." This should read decimeter, the amounts named being 100 times too large. On p. 251 also the last two sentences of the middle paragraph should be transposed, the last one being meaningless in its present position.

Inasmuch as the cross-references are to sections it would have been convenient to have the section numbers in the page head, as in the German book. This disadvantage is much more than balanced, however, by the very complete index, an essential feature absent from the original.

The second volume is awaited with the greatest interest, and we trust the English version will appear promptly as promised. And we must not allow any differences of opinion or defects in the translation to minify our obligations to Professor Ewart and to the Clarendon Press for the helpful and elegant volumes.— C. R. B.

NOTES FOR STUDENTS.

Dr. J. Loeb has begun the publication of a series of articles containing new facts and ideas concerning the constitution of living matter, to which the attention of botanists should be directed. The first one,[2] on the poisonous

[2] Am. Jour. Physiol. 3: 327–338. 1900.

character of a pure NaCl solution, points out that the salts or electrolyte in general do not exist exclusively as such in living tissues but are ionized, and these ions are united with the proteids. "The great importance of these ion-proteid compounds lies in the fact that by the substitution of one ion for another the physical properties of the proteid compounds change. This accords with Dr. Loeb's own results on variable absorption of water by muscle, according as Na, K, or Ca ions were present, and explains some facts regarding the effects of salts upon turgor in plants. Loeb found pure NaCl solutions of equimolecular strength with sea water poisonous to Fundulus, a fish which can endure a great increase in the concentration of sea water, even an addition to it of 5 per cent. NaCl, while in distilled water young fish lived indefinitely. (True had previously shown that NaCl and KNO_3 are poisonous to Spirogyra.) He also found the medusa of Gonionemus non-contractile in NaCl, and was able to control its contractility at will by varying the solutions; ciliary movement and development in young larvae of the sea urchin could be modified in the same way. Loeb's conception as to the relation of metal ions to proteids and the protoplasmic functions suggests reexamination of the conclusions as to the elements necessary to the healthy development of plants. These conclusions have been based chiefly on the use of nutritive solutions from which certain salts were successively omitted. One element, however, may only be necessary to antagonize the action of another.— C. R. B.

THE FOURTH PAPER in Professor F. O. Bower's series entitled "Studies in the morphology of spore-producing members," deals with the leptosporangiate ferns.[3] The preceding papers dealt with Equisetineæ and Lycopodineæ (published in 1894), Ophioglossaceæ (in 1896), and Marattiaceæ (in 1897). The importance of the present contribution, dealing with the greatest of the pteriodphyte groups, can hardly be overestimated. In our limited space it is impossible to note a tithe of the interesting observations and suggestions. It will be remembered that Professor Bower excludes both Isoetes and Ophioglossaceæ from the Filicales, and in the present paper he only considers the homosporous forms. As thus limited, he proposes the three following great divisions of homosporous Filicales, which he calls sub-orders: *Simplices*, *Gradatae*, and *Mixtae*.

It may serve to a better understanding of the characters upon which these divisions are established to indicate the groups which they include. The *Simplices* include Marattiaceæ, Osmundaceæ, Schizæaceæ, Gleicheniaceæ, and Matonineæ; the *Gradatae* include Loxsomaceæ, Hymenophyllaceæ, Cyatheaceæ, Dicksonieæ (exclusive of Patania, Woodsia, Hypoderris, and Deparia), and Dennstaedtiinae; the *Mixtae* include Davallieæ (exclusive of

[3] Phil. Trans. Roy. Soc. B. 192: 29–138. *pls. 2–7.* 1899. London: Dulau & Co., 37 Soho Square, W. 8*s*.

Microlepia), Lindsayeæ, Pterideæ, and other Polypodiaceæ, together with Woodsia, Hypoderris, and Deparia.

It is noted with interest and approbation that the terms Eusporangiatae and Leptosporangiatae are dropped as designating systematic divisions, but retained as descriptive words. The difference in the mode of origin implied by these terms is regarded as marking no important biological feature, whereas the distinction between the three groups proposed rests upon facts of far-reaching biological significance, and conveys in each case a definite morphological conception.

In the *Simplices* the sporangia are of simultaneous origin, upon a receptacle which may be slightly sunken, flat, or slightly projecting; also, they are of relatively large size, sessile, and usually produce a large output of spores (ranging from 128 to over 7000). The annulus when present is oblique, and dehiscence is in a median plane, correlated with freedom for lateral spreading. The protective arrangements are usually absent or inefficient, and the whole group is to be regarded as displaying primitive characters.

In the *Gradatae* the sporangia are borne in basipetal succession, with regular orientation, upon a more or less elongated receptacle; also they are usually of smaller size, sessile or with short stalks, and the output of spores is typically sixty-four or lower. The dehiscence is lateral and oblique; and the annulus is oblique, correlated with freedom only in a direction obliquely upwards. In general the indusium is present as a basal cup or basal flaps.

In the *Mixtae* the sporangia are of various ages intermixed, without regular orientation, upon a sunken, flat, or slightly projecting receptacle; also they are relatively small, with more or less elongated and thin stalks, and the output of spores is sixty-four or under. The annulus is vertical, and the dehiscence transverse, correlated with freedom directly upwards. The protective arrangements are various, and often elaborate.

These three divisions the author regards as illustrating the three steps in the evolution of the sporophyte in homosporous Filicales. He does not suggest a single line of descent, but rather parallel development, the members of each of the three divisions not necessarily being of common descent, but grouped according to common adaptation, just as are the seed-plants.

It would be profitable to consider the summaries of information given under each group; also the morphological discussion of the sorus, including the indusium, the receptacle, and the sporangium with its stalk, annulus, and output of spores; and also the discussion of the biology of the sorus, which includes the production and nutrition of spores, their protection till maturity, and their dispersion; but for all these interesting topics the original paper must be consulted.—J. M. C.

MR. W. A. CANNON has published the results of a morphological study of the flower and embryo of *Avena fatua*, the wild oat (Proc. Calif. Acad.

III. 1 : 329–364. *pls. 5.* 1900.) The investigation of some of the grasses from the modern morphological standpoint has long been a *desideratum*, as they have had the reputation of being exceptional in certain features, and because of the question as to their primitive or reduced character. The author states his results in a remarkably clear and well organized summary, from which certain points bearing upon mooted questions may be noted. The lodicules are regarded as stipular rather than "perianthal;" the earlier growth of the stamen is mainly intercalary in the anther; the staminate archesporium is composed of a single row of cells, and each spore mother cell touches the tapetum; the wall of the microsporangium consists of tapetum, middle layer, and endothecium; the generative nucleus divides in the pollen grain, and the male cells are elongated spindle-shaped; the archesporial cell of the ovule cuts off no tapetum; the four potential megaspores are formed in various ways, (1) by four nuclei without cell walls, (2) by the development of four nuclei which later are separated by walls, (3) by the usual appearance of walls following each nuclear division, in which features there is a close resemblance to Eichhornia as investigated by R. Wilson Smith; the antipodals multiply before the fertilization of the egg, becoming thirty-six or more in number, and begin to disorganize with the beginning of endosperm development, apparently serving to nourish the forming endosperm, as that in turn nourishes the embryo; the endosperm first aggregates about the forming embryo, a fact which seems to be correlated with the feeble development of the suspensor, which consists of but a single cell; in its development the embryo of *Avena fatua* illustrates all three of the "types" of Nörner; the cotyledon and the stem-apex are derived from the distal segment, the root, the root-cap, and periblem initials of the root from the middle segment, and the coleorhiza from the basal segment; the organs of the embryo originate in the distichous manner characteristic of the vegetative leaves of grasses.

It is to be regretted that the author's material did not permit him to determine the fate of the second male cell, especially in a family in which the phenomenon of xenia occurs, which seems to be best explained as an evidence of double fertilization.—J. M. C.

DR. ARNOLD GRAF objects to the term cytology as far too general, and proposes the following subdivisions of the subject: cyto-morphology (external form and size); cyto-anatomy (organization); and cyto-physiology. The latter is further divided into *a*) cyto-mechanics (physical properties and behavior to mechanical stimuli), including cyto-statics (conditions of equilibrium) and cyto-dynamics (phenomena of motion, including cell-division maturation and fertilization, death and *pro parte* pathology); and *b*) cyto-chemistry.—C. R. B.